JPRS-UEA-85-007

14 February 1985

# USSR Report

## ECONOMIC AFFAIRS

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# USSR REPORT

## Economic Affairs

## Contents

ECONOMIC POLICY, ORGANIZATION AND MANAGEMENT

# ECONOMIST RESPONDS TO READERS' QUERIES ON INTENSIFICATION

Moscow EKONOMICHESKIYE NAUKI in Russian No 9, Sep 84 pp 123-128

[Response to reader's question by G. Zhuravleva, candidate of economic sciences, docent: "Answers to Readers' Questions"]

[Text] What are the indicators used for describing the process of intensification of public production? G. Zhuravleva, candidate of economic sciences, docent, answers this question.

An assessment of the process of intensification of public production as a whole and of individual sectors of the national economy and enterprises must be oriented toward a specific criterion and the indicators describing it. Establishing a criterion of intensification for public production means finding that basic attribute on the basis of which the process can be given a qualitative assessment.[1]

The criterion of intensification must obviously reflect economic relations, precisely those relations which develop among people in the process of providing conditions for the fullest degree of satisfaction of the needs of members of the socialist society and for the all-round development of the individual by constantly improving the essence and conditions of labor and making it more effective. Relations of this type are structurally complex and multifaceted, of course. In order to reveal the substance of this criterion quantitatively it is therefore necessary to use a system of intensification indicators. These can be broken down into the following groups according to their main features:

according to the scope of the assessment (intensification indicators at the level of the entire national economy, the sector, individual organizations, enterprises, brigades and workers);

according to the degree to which the results of the use of resources are generalized (in the first place, generalized indicators--growth of productivity for public labor, the portion of the total output volume obtained with the intensive factors, and others; in the second place, partial indicators describing the intensification of live labor, productive capital, capital investments and so forth);

according to the nature of the indices--economic and social; in value and in physical terms; absolute and relative. The latter are especially important for comparing the level achieved with that which is realistically

possible at the current stage in the development of the scientific and technical revolution, and for comparing the natural situation with that which has developed in other industrial nations, with established world standards, and so forth.

according to the nature of the processes determining the intensification of public production. It would be worthwhile to consider this group of indicators in somewhat greater detail.

Intensification calls for improving production factors for purposes of achieving the best result. In other words, it can be regarded as a system in which the end and the means are combined. The indicators describing this process can therefore also be broken down into two subgroups. It is valid to include in the first subgroup those which reflect the improvement of production factors and describe the technical and economic level of the latter during each specific period.

What sort of indicators are these? In the first place, those which reflect the technical and economic level of the means of labor (the composition of the equipment according to "age," the degree to which it is usable or is worn out, the specific portion of obsolete equipment, its renewal coefficient, the portion of active fixed production capital and highly productive equipment, the per unit capacity and productivity of the equipment with respect to the main types of products, and rates of replacement of one generation of machinery with another). We should especially stress the importance of the renewal coefficient for the means of labor as an indicator. This indicator very distinctly embodies the degree to which the achievements of scientific and technical progress are being applied.[2]

The level of utilization of buildings, installations and other means of labor at an enterprise, in a shop or section is described by the following indicators: volume of output from 1 square meter of production area (the ratio of the volume of output produced in the given area during a specific period to the size of the existing production area); the use coefficient for production areas (the ratio of the actual volume of output per 1 square meter of production area during the given period to the volume of output established for that area by progressive standards).

The level of utilization intensity for the equipment is described by means of an intensive equipment load factor. The latter is a partial indicator obtained by dividing the quantity of output which should have been obtained according to the established norm for the specific period by the actual volume of output per unit of time.

The degree of physical wear and tear on the fixed capital is described by such indicators as the serviceability coefficient or the specific portion of the total value of the fixed capital accounted for by equipment which has not been worn out; the coefficient of physical wear and tear on fixed capital (the ratio of the total wear and tear on the fixed capital to their initial value); the percentage of physical wear and tear on buildings, installations and so forth. At the beginning of the 80's two-thirds of the fixed industrial production capital in the nation consisted of the latest means of labor less than 10 years old;

approximately half of this capital has been used less than 5 years.[3] Today, the production of approximately 20,000 new types of equipment is mastered in the nation during a five-year period. This is a considerable number, of course. The demands of contemporary scientific and technical progress, however, make it necessary to accelerate production's technical renewal. This need is substantially demonstrated by the large specific portion of obsolete products in the output, which is due in great part to a shortage of the latest means of production. Products which have been produced for more than 10 years accounted for 30.6 percent of the total in 11 machine building ministries in 1981, for example, and that portion had not only not been reduced but had even grown (it was 16.2 percent in 1967).[4]

In the second place, there are the indicators describing the extent to which labor is provided with technical equipment (capital-labor ratio)--the ratio of the average annual value of the production capital to the average listed number of workers in industry or agriculture; power-worker ratio--the ratio of the total capacity of operating power equipment to the average annual number of workers; machine-worker ratio--the ratio of the active portion of the fixed capital to the average annual number of workers).

Intensification, the material foundation for which is new equipment, is producing a rapid growth of fixed capital. All of the fixed capital in the national economy was calculated at 1,968 billion rubles at the end of 1982. This was a 2.3-fold increase over the 1970 level. The average annual number of workers employed in the national economy increased by only 25.4 percent during that period, however (from 64.8 million in 1970 to 80.3 million in 1982). These figures show the growth of the capital-labor ratio, which grew in the material production sphere from 5,500 rubles per worker in 1970 to 10,700 in 1980. During the 11th five-year period the capital-labor ratio is increasing by 45 percent on the kolkhozes and sovkhozes, by 34 percent in industry and by 25 percent at transport and communication enterprises.[5] Increasing the capital-labor ratio by 1 percent provides an increase of 0.6 percent in labor productivity during the 11th five-year period, compared with 0.4 percent during the 10th five-year period.

The available capital factor (the value of fixed agricultural production capital per 100 hectares of arable agricultural land) is used in agriculture. It was 41,600 rubles as of 1 January 1981. The available capital factor will grow considerably during the 11th and 12th five-year periods as a result of the implementation of the Food Program of the USSR.

The following figures illustrate the growth of the capital-labor ratio. If we take the power-worker ratio in industry in 1940 as the basic unit, it amounted to 5 units in 1970, 7.2 units in 1980 and 7.4 units in 1982, and an average of 24,800 kilowatt/hours was used per industrial worker in 1970, 36,600 in 1980. The power/worker ratio grew from 1.7 hp in 1940 to 28.4 hp in 1982.

The level of productivity for the operating means of labor is manifested in the available materials factor for the fixed capital. It reflects the quantity of raw and processed materials processed during a specific period of time per unit of means of labor. The dynamics of this indicator demonstrate that as the

technical basis, the per unit capacity and productive capability of the means of labor grow, they activate an ever-increasing quantity of the objects of labor.

In the third place, there are the indicators describing the level of labor mechanization and automation for the main and auxiliary jobs, as well as the degree of development and use of progressive technological processes and the specific portion of output produced with modern, effective technology in the total volume of a specific type of product.

The level of production mechanization (automation) can be expressed with a number of indicators: the production mechanization (automation) coefficient--the ratio of the volume of output produced by means of machines (automatic devices) to the total volume of output; the job mechanization (automation) coefficient--the ratio of the amount of labor in hours performed by a mechanized (automated) method to the total amount of labor outlays for producing a specific volume of output; and the labor mechanization (automation) coefficient--the ratio of the number of workers employed at mechanized (automated) jobs to the total number of workers in the specific section or enterprise. Production intensification is accompanied by the elimination of manual labor (this is especially urgent in auxiliary production operation, where the mechanization level is only 29 percent [6]), as well as the adoption in production of automatic manipulators (robots) with programmed control. More than 7,000 of the latter were produced in 1983 alone.

The intensification of production involves not only its automation and mechanization, but also the adoption of the latest technology, particularly resource-conserving technology, by means of which materials, energy and human labor are conserved.

In the fourth place, there are the indicators describing the technical and economic level of the product turned out. They reflect the quantity of the specific types and items or the specific portion accounted for by such products in the total volume of the items produced, which either exceed or conform to the highest achievements of Soviet and foreign science and technology; conform to existing standards and technical specifications (or, on the contrary, do not conform to the modern demands and should be modernized or taken out of production); are being mastered for the first time in the USSR and are competitive (this includes being patentable and patent-pure) and are modern products in general. Specific assignments for improving the most important technical and economic indices of products--those describing the performance, the economy, reliability, durability and capacity of items, and so forth--are now being set in the five-year and annual plans. The five-year plan for 1981-1985, for example, calls for increasing the durability and reliability of the equipment produced by an average of 25-35 percent. Increasing the durability of products within economically optimal and technically expedient limits produces a large national economic effect since it reduces operating costs and equates to additional output. Increasing the average durability of products by 10 percent is equal to the production of an additional 8 million units annually in the automobile and bicycle tire industry, for example, around 2 million tons of additional steel pipe, more than 100 million additional roller bearings, and around 200 million electric light bulbs annually.

In the fifth place, there are indicators describing the level of production organization (the degree of labor distribution, development of the brigade labor

organization system, scientific organization of labor, the adoption of efficient work procedures and methods, smoothness and regularity of the production process, the level of specialization or production cooperation, the combining of production operations, production concentration, and others).

According to the USSR State Committee for Labor and Social Problems it is planned to reduce the need for workers by approximately 4 million people just by applying a system of measures to achieve scientific organization of labor in the national economy during the 11th five-year period.

The intensification of specialization and structural improvements in the economy are especially important for describing intensification from the standpoint of public reproduction. At the present time 3-5 percent of the total volume of output for interbranch use is produced at specialized enterprises. In machine building these enterprises account for 1.5-2 percent of the total volume of products and services for interbranch use.[7] Calculations show that the optimal level of specialization for industry as a whole could be achieved by reducing the labor-intensiveness of products 3- to 5-fold, 6- to 8-fold for individual types, the capital-output ratio 1.5- to 2-fold, and consumption of materials 1.5- to 1.7-fold.[8] Thoroughgoing structural improvements resulting in the preferential development of the more progressive production operations or the concentration of the bulk of output in them are involved in the enhancement of the process of intensification of the economy.[9]

In the sixth place, there are indicators describing the qualitative composition of the workers (the occupational structure and the level of training of cadres, their conformity to their field of work, the availability of workers with the highest skills level, engineering and technical personnel and scientists, which is especially important in connection with the creation of scientific production associations and with the development of scientific research at the enterprise itself). One-fourth of all the world's scientific workers work in the USSR, and the total number of scientific workers in our nation increased from 98,300 in 1940 to 1.4 million in 1982. The saving achieved in the national economy by using them demonstrates the good results of their scientific developments. It amounted to 12.3 billion rubles during the 9th five-year period and reached almost 18.5 billion rubles during the 10th.

Reducing the number of workers engaged in manual labor, primarily in auxiliary and subsidiary jobs, in all the branches is one of the most important tasks of the 11th five-year period. The five-year and annual plans now include figures for the specific portion of the total workforce engaged in manual labor (in percentages of the total number of workers) at the end of each year of the five-year period.

In the seventh place, there are indicators for the structure and the efficient use of capital investments (the specific portions of outlays for improving the quality and enlarging the assortment of products; the portion of the total volume of capital investments in a branch spent for equipment; the specific portion of capital investments applied for reconstruction and technical re-equipment in the total volume; the volume of incomplete construction, and construction periods, as well as the mastery of production capacities, the designing of projects, and others). Capital investments in the national economy will increase by 10.4 percent during the 11th five-year period while the national income will grow by 18

percent. This ratio convincingly demonstrates the course toward intensification of public production. The significant slowdown in rates of growth for capital investments during the 11th five-year period should be compensated for by altering their structure. We know that the reconstruction and technical re-equipment of existing production facilities are far more effective than new construction. Growth of production capacities in this case is achieved on the average three times as rapidly and at much lower cost, and the need for workers is also reduced.

The indicators we have listed describe the intensification of public production and help us to get an idea of the type of reproduction involved.

Now let us return to the second subgroup of indicators for the intensification of public production. Unlike the first subgroup, it describes to a certain degree both the type of reproduction and its results (its effectiveness). These indicators include public labor productivity, the output-capital ratio, capital-intensiveness, materials-intensiveness, the improvement of product quality, the conservation of material and labor resources, and others.

In this subgroup of indicators we can isolate those which reflect the effectiveness of live labor (the personal factor) and embodied labor (material factors) of production.

The effectiveness of live labor is described by labor productivity (the volume of net or gross output per average listed worker); rates of growth of labor productivity; the portion of net output obtained as a result of that growth; and conservation of live labor. An increase of labor productivity is an inevitable result of the intensification of public production, because the use of advanced achievements of science and technology (which are the essence of the intensification process) provide for a growth in production output with a smaller number of workers. An increase of 1 percent in labor productivity (1982 figure), for example, made it possible to obtain 5 billion rubles in national income and to increase the output of manufactured goods by more than 6.5 billion rubles worth. The latter is the equivalent of starting up more than 500 large new enterprises. It is planned to save the work of 17 million people during the 11th five-year period by increasing labor productivity in the national economy as a whole.

It was pointed out back at the November 1982 Plenum of the CPSU Central Committee that labor productivity is growing at rates with which we cannot be satisfied.[10] Labor productivity in industry grew by 34 percent during the 9th five-year period, increasing at an average annual rate of 6 percent; overall growth of labor productivity amounted to 17 percent during the 9th five-year period, with an average annual growth rate of 3.2 percent.[11] Under the 1983 plan labor productivity in industry was to grow by 3 percent, but the actual growth rate was 3.5 percent. A 3.4 percent growth rate for labor productivity is planned for 1984 in industry, 8.5 percent in agriculture (the public sector).[12] Data on progress in the fulfillment of the 1984 plan permit us to expect that even higher figures will be achieved.

We know that the intensification of live labor has both physical and social limitations. V.I. Lenin demanded that we combine the modern methods for increasing labor productivity developed in the advanced capitalist nations "...with a

reduction of work time and the use of new methods of production and labor organization, without any detriment to the work force of the laboring population."[13] Consequently, it is valid to speak of a socially normal intensiveness for labor under socialism. It seems to us that socially normal intensiveness in the developed socialist society should make it possible to accomplish production tasks with an increase in labor productivity while simultaneously creating the conditions for bringing out the physical and spritual potentials of man to the fullest possible degree and for the individual's balanced development.

Reducing or eliminating losses of live labor (intra-shift downtime, and so forth) has a large role in the intensification of labor. This makes it possible to obtain an additional quantity of products without enlarging the production apparatus, without additional capital investments or an increase in the number of workers. We know that the loss of only a minute of worktime on the national scale is equal to the loss of the results of a day's labor for more than 250,000 workers.[14] Reducing losses of worktime by 50 percent would make it possible to obtain an additional 30-36 billion rubles worth of manufactured goods annually.[15]

The growth of labor productivity inherent in the intensive type of production alters the balance between the live and embodied labor spent on output. The use of more and more embodied labor is one of the most important features of production intensification, and therefore the more urgent is the task of making more effective use of the labor embodied in the means of production.

The intensification and effectiveness of embodied labor are described by the indicators of capital-output ratio (the volume of national income produced, of net or gross output per ruble of the average annual value of the production funds), capital-output ratio (the reverse of the output-capital ratio indicator), materials-intensiveness (materials used per unit of output or, as an example, the consumption of standard fuel per one kilowatt-hour of electric energy released, and so forth), metal consumption (consumption of metal per 1 million rubles worth of gross output for industry), the reduction in depreciation per unit of consumption value, conservation of materials and others.

The output-capital ratio is one of the indicators which summarize most completely the level and effectiveness of the use of fixed production capital. Increasing output from operating fixed capital by 1 percent makes it possible (calculated for 1985) to obtain an additional 15.5 billion kilowatt-hours of electric energy, around 1.2 million tons of rolled ferrous metal, 2.5 billion rubles worth of machine-building and metal-working products, more than 1.5 million tons of mineral fertilizer, 1.2 billion rubles worth of light industry's products and 610 million rubles worth of goods for cultural and personal use. Increasing the capital-output ratio by 1 percent for the national economy saves a total of more than 10 billion rubles in capital investments.

We cannot ignore the fact that there are real factors which contribute not only to an increase in the output-capital ratio, but to a reduction as well. In agriculture, for example, there are great losses of output due to the fact that the crop is not harvested at the right time. These losses can be avoided by doubling the combine pool or increasing it even more. The gross harvest will increase in smaller proportion than the cost of the equipment used, however, as a result of which the indicator for the return from fixed capital in agriculture

will be reduced. The output-capital ratio is also reduced when modern equipment is developed with a view either to simplify its operation or to bringing it into greater conformity with environmental protection requirements, and the increased cost is not compensated for by a corresponding growth of output.

With an increase of 17 percent in public labor productivity in industry during the 10th five-year period, the output-capital ratio was reduced by 14 percent in material production as a whole.[16] During the current five-year period it is planned to equalize the growth of labor productivity and its capital-labor ratio and on this basis, to slow the rate of reduction in the output-capital ratio.

It is interesting to note that with a reduction in the output-capital ratio as a whole from 0.48 in 1958 to 0.31 in 1980, the output from new capital dropped even more--from 0.52 in 1958 to 0.16 in 1980. Consequently, while an increase of one ruble in the production capital produced a 52 kopeck growth of national income in 1958, the figure was only 16 kopecks in 1980. One of the main reasons for this lies in the inadequate rate of replacement of machinery and equipment with more progressive types and in an increase in the rate at which the equipment wears out or becomes obsolete. The established coefficient for the removal of fixed capital in industry is 5.6 percent annually, which means that it is totally replaced over a period of 18 years. This indicator has been deteriorating in recent years, and the equipment renewal periods have grown longer. This is why materials from the 26th party congress and a number of subsequent plenums of the CPSU Central Committee directs attention to the priority needs to remodel or renew existing production operations over new construction. This will produce a tangible effect even during the 12th and 13th five-year periods.[17] The overcoming of the trend toward a reduction in the output-capital ratio which developed in the 60's by improving the use of production capital is an important element of intensification.

The capital-output ratio is the reverse of the output-capital. It is reduced by activating reserves more fully, by making intensive use of production capacities, increasing the equipment load, increasing the output from 1 square meter of production area, and so forth. An increase in the capital-output ratio for products is not always contrary to the interests of production intensification, however. A more rapid growth of power engineering than of the food industry, for example, is an indication of public production's intensification. This situation can lead to a growth of the capital-output ratio for industry as a whole, however, since the output-capital ratio in the energy branches is 26 kopecks per ruble of fixed production capital, but approximately 3 rubles in the food industry. A high capital-output ratio is therefore not always an indication of falling behind.

The materials-intensiveness of products is the next most important indicator for the intensification process. In accordance with the decree passed by the CPSU Central Committee and the USSR Council of Ministers "On Intensifying the Work Performed to Achieve Conservation and Efficient Use of Raw Materials, Fuel and Energy, and Other Material Resources" (1981), a ceiling is set for material outlays in monetary terms per ruble of output (work) as production (job) costs assignments in the five-year and annual plans for industry, construction and transport, beginning in 1983. Reducing the amount of waste and losses of raw and processed materials in all the stages of their processing, storage and transportation, and making fuller use of secondary resources and incidental products

help to reduce the material-intensity of production. Reducing waste of finished rolled ferrous metal in machine building and metal processing by 1 percent, for example, produces materials adequate for turning out an additional 160,000 Zhiguli motor vehicles annually.

Production intensification and the adoption of new equipment affect the conservation of both live and embodied labor. The freeing of workers from the production process is an important result of intensification, especially today, when the demographic situation has become more complicated.

It has been calculated that the consumption of raw and processed materials and fuel in our nation almost doubles every 10 years. As a result, a 1 percent conservation of material resources in the national economy is producing an increasingly larger growth of national income: 1.6 billion rubles in 1960, 3 billion in 1970, more than 6.5 billion in 1980, and approximately 7 billion rubles in 1985. A reduction of 1 percent in the consumption of material resources today permits the national economy to operate with the raw and processed materials saved for 3 or 4 days a year.

When we speak of the conservation of materials, it is important to bear in mind the fact that the combined outlays for saving a unit of these resources are 3- to 5-fold less than the cost of producing them. It is therefore expedient to shift the focus of the campaign against shortages for certain types of raw materials to the area of their use.

The large specific portion of the replacement fund (56 percent) in the cost of a product makes it necessary to make intensive use of both the objects of labor and the depreciation fund, which amounted to 68.2 billion rubles, or 63.6 percent of the accumulation fund, in 1980.

The intensification of public production is characterized by an acceleration of production capital turnover. The following indicators are used to define this process: the number of rotations, the rate of turnover in days and the total volume of circulating capital for a specific production volume. A comparison of planned (actual) indicators with the basic indicators defines the level of the turnover rate. Accelerating the turnover rate for materials by just 1 day for the nation as a whole saves more than 1.5 billion rubles.

The end result of production intensification is manifested not just in economic ways: the conservation of public labor, the buildup and effective use of capital, and the reduction in outlays of raw and processed materials, fuel and live labor per unit of finished product. This process also has a social effect--alteration and enrichment of the essence of the work and the improvement of working conditions, its transformation into a prime vital need, the balanced development of the worker himself, and the shaping and development of the socialist way of life.

Comrade K.Yu. Chernenko pointed out at the February 1984 Plenum of the CPSU Central Committee that the new, 12th, five-year period "...must be the beginning of profound qualitative changes in production, a five-year period of determined breakthrough in the intensification of all the sectors of our national economy."[18] Most active preparations are being made for the accomplishment of

this task today, when most of the 4th year of the 11th five-year period is behind us. Furthermore, it is important to remember, among other things, the fact that production intensification is not just a technical and technological, and economic and organizational problem, but is to a large degree a psychological problem. The orientation toward the intensified path of development should become an organic part of the way of thinking not only of those in charge, but of all the members of society, because it depends directly upon the activity level of all the workers, who are the full co-owners of the national wealth.

FOOTNOTES

1. Various ideas are expressed in the economic literature on the criterion of production intensification. The following factors, among others, are regarded as such a criterion: conservation of outlays of live and embodied labor per unit of output (see V. Bondin, "K. Marx on the intensiveness of public production," EKONOMICHESKIYE NAUKI No. 4, 1983, p. 12; "Politicheskaya ekonomiya. Slovar'" [Political Economy: A Dictionary], Moscow, 1983, p 147); the degree to which the lower boundary of effectiveness for the use of machinery under socialism is raised--the degree to which manual labor is eliminated (see K. Plotnikov, "The Mechanism of Production effectiveness," VOPROSY EKONOMIKI, No. 1, 1983, p 142 and others); the production time materialized in the product turned out (see M. Magomadov, "The Interrelation Between Intensification and Production Effectiveness," EKONOMICHESKIYE NAUKI, No. 1, 1983, p 30). Most economists accept the portion of growth in the national income achieved by increasing labor productivity as the criterion.

2. In addition to scientific and technical progress, production intensification is influenced by structural, personnel and natural factors, by the improvement of production management, the effectiveness with which Soviet and foreign advanced know-how is disseminated, and a number of other processes.

3. Ye. Smirnitskiy, "Ekonomiya i berezhlivost'. Slovar'-spravochnik" [Conservation and Thrift: A Reference Dictionary], Moscow, 1983, p 67.

4. Ya Ryabov, "Control of Scientific and Technical Progress and the Growth of Production Effectiveness," PLANOVOYE KHOZYAYSTVO, No. 10, 1982, p 5.

5. Calculated from "Narodnoye khozyaystvo SSSR v 1982 g." [The National Economy of the USSR in 1982], Moscow, 1983, pp 46, 367.

6. It is interesting to note that the effectiveness of measures carried out to mechanize the labor of auxiliary workers is 2.8- to 3.5-fold greater than for those employed in the main production process (V. Silin and A. Sukhov, "Intensification--a Crucial Factor of Economic Growth," PLANOVOYE KHOZYAYSTVO, No. 5, 1983, p 106).

7. PLANOVOYE KHOZYAYSTVO, No. 5, 1983, p 106.

8. Yu. Lavrikov, "The Organization of Public Production--an Important Factor in its Intensification," EKONOMICHESKIYE NAUKI, No. 8, 1981, p 27.

9. For a more detailed account read V. Loginov, "Intensification of the Economy and Structural Improvements," VOPROSY EKONOMIKI, No. 10, 1983, pp 36-41.

10. "Materialy Plenuma Tstntral'nogo Komiteta KPSS 22 noyabrya 1982 goda" [Materials From the 22 November 1982 Plenum of the CPSU Central Committee], Moscow, 1982, p 8.

11. G. Marchuk, "Scientific and Technical Progress--the Foundation for Intensifying Public Production," KOMMUNIST, No. 4, 1983, p 63.

12. N.K. Baybakov, "O Gosudarstvennom plane ekonomicheskogo i sotsial'nogo razvitiya SSSR na 1984 god i vypolnenii plana v 1983 godu" [On the State Plan for Economic and Social Development of the USSR in 1984 and Plan Fulfillment in 1983], Moscow, 1984, p 8.

13. V.I. Lenin, "Poln. sobr. soch." [Complete Collected Works], Vol. 36, p 141.

14. For a detailed account of ways to reduce losses of worktime read "Ways to Reduce Losses of Worktime: Facts and Figures," POLITICHESKOYE SAMOOBRAZOVANIYE, No. 11, 1982, pp 143-145.

15. Ye. Smirnitskiy, op. cit., p 95.

16. For details read V. Silin and A. Sukhov, "Intensification--a Crucial Factor of Economic Growth," PLANOVOYE KHOZYAYSTVO, No. 5, 1983, p 104.

17. V. Trapeznikov, "Management and Scientific and Technical Progress," PRAVDA, 7 May 1982.

18. "Materialy vneocherednogo Plenuma Tsentral'nogo Komiteta KPSS 13 fevralya 1984 goda" [Materials From the Special Plenum of the CPSU Central Committee, 13 February 1984], Moscow, 1984, p 16.



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INDUSTRIAL DEVELOPMENT AND PERFORMANCE

## MORE THOROUGH ANALYSIS OF PRODUCTION CAPACITIES ADVOCATED

Moscow VESTNIK STATISTIKI in Russian No 9, Sep 84 pp 3-12

[Article by I. Pogosov: "Improve the Study of Production Capacities"]

[Text] The development of plans for production associations, combines, enterprises and organizations on the basis of economic and engineering calculations demands careful analysis of the availability and use of production capacities. The compilation of a plan of production output begins with determination of the need for it and a calculation of the balance of production capacity on whose basis reserve capacities not utilized at the planned level of production as well as the need for creation of additional capacities are revealed.

Examination of questions of utilization of production capacities connected with the general problem of efficiency of industrial and all public production demonstrates its multi-faceted nature and complexity. Contributing to the solution of this problem, statisticians working in the field of industry have developed a whole series not only of theoretical, methodological and organizational practical questions but also a series of new statistical studies which they have introduced into practice. These include (the listing is far from complete): statistics of availability and use of production capacities for production output; reporting on the utilization of planned indicators of new facilities for production output, labor productivity and production cost of a production unit; accounting of the presence, renewal, use and age of basic types of equipment; surveys of new enterprises and facilities according to basic indicators--commodity production, labor productivity, capital-labor ratio, output-capital ratio and others in comparison with indicators of enterprises that were earlier put into operation; surveys of shift system and use of operating time of equipment in machine building and certain other sectors.

The enumerated studies make it possible to reach the conclusion that recently a new division of industrial statistics has been created in practice--the statistics of production capacities.

At the present stage of development of the economy, questions of intensification of production are extremely pressing. In this connection, a number of new problems in the field of study of production capacities and use

of equipment are in urgent need of solution. The working up of plan balances and calculations of use of production capacities and fixed capital are essential in validation of drafts of five-year and annual plans so that funds are allocated only in the case where requirements for production output cannot be provided by existing enterprises with sufficient economic effectiveness. With reference to these tasks, requirements have to be formulated at the present time for drawing up balances of production capacities as well as for data on utilization of planned capacities.

The production capacity of enterprises is predetermined by availability and level of use of machine tools, machines and other equipment. An important factor in effective use of equipment is first of all its timely startup. In many sectors, the value of uninstalled equipment is estimated at millions of rubles. It does not take part in the production process, ages and, because of often becomes inoperable due to poor storage, and accessory components are lost. Timely placement of uninstalled equipment into operation constitutes a serious reserve in increasing production.

For the purpose of characterizing the use of installed equipment in industry, a comprehensive system of indicators is employed. These indicators reflect the use of available equipment in terms of time and productivity while taking into account the specific character of individual production operations. Thus in ferrous metallurgy, use of capacity is calculated for net volume of blast furnaces (ratio of net volume in cubic meters to number of tons of smelted iron per day), daily output of steel per square meter of floor area of open-hearth furnaces; at electric power stations--use of capacity of electric power stations (ratio of average number of hours of operation of 1 kilowatt of installed capacity in course of year to number of hours per year--8760). Indicators of use capacity of equipment in machine building include: amount of installed and actually operating equipment, shift coefficient of equipment operation, number of hours of its operation and productivity (outlays of machine-hours per production unit).

In analyzing data for equipment use, it would seem useful to first of all examine the amount of idle equipment, that is, equipment that has not been in operation in any one of the shifts and the reasons for downtime around the clock. Indicators characterizing the amount of installed and actually operating equipment give an idea of the amount of equipment that is operating or idling not only in the course of the studied days but also during the first, second and third shifts. A part of the equipment is idle because of planned preventive maintenance or modernization as well as because it is kept in reserve or moth-balled. The system of planned preventive maintenance adopted in industry is aimed at prevention of breakages and breakdowns and contributes to increasing the operational time of equipment. Observance of maintenance schedules, ensuring good care of equipment extends its "life" and contributes to reducing downtime. Stand-by equipment in conformity with prescribed norms is essential for production. Basic downtime is connected with defects in organization of production and labor (worker reduced strength, inoperability and unplanned repairs), material-technical supply and with organizational and technical difficulties in production. It is important to determine which equipment is in excess for an enterprise and implement measures for its sale.

As a rule, equipment load is not uniform over the course of 24 hours: the biggest load is in the first shift, reduced load--in the second shift and practically no load--in the third shift.

The shift aspect of equipment operation needs to be studied not only for the sector or enterprise as a whole but also for the structural subdivisions of the latter, for individual groups of machine tools and in needed cases--for their type sizes. It frequently happens that at the time where some machine tools, for example, turning lathes, are loaded two shifts, while others, for example, slotting machines and planers, operate an incomplete shift. Analysis of the equipment load of individual enterprises, shops and sectors for groups of metalworking equipment makes it possible to outline ways of improving the park structure for the purpose of fuller and more uniform load of equipment of all technological groups.

In the problem of the shift factor in operation of equipment, technical, economic and social aspects should be distinguished. The pressing nature of the shift problem in operation of equipment increases with reduction of the length of the workday, growth of capital outlays for the creation of a single workplace and increase of the capital-labor ratio. The longer the time of fixed-capital operation, the bigger the production output per ruble of this capital and the smaller the losses as a result of its obsolescence. Higher shift use constitutes a significant factor in bringing closer the time periods of physical wear and obsolescence of equipment and the factor of dealing with immobilization of invested capital. At the same time the most effective way is increasing the shift factor in operation of equipment without increasing the shift factor of workers.

It is very important to utilize more fully production areas--the sum of areas of fixed production sectors directly engaged in production output and areas of auxiliary sectors and services (tool, repair and power shops and sectors and sanitary-engineering and fire services). In a number of cases where production capabilities directly depend on the existences of areas, the capacity for production output is computed on the basis of the production area. Such calculations in particular are performed on the basis of assembly shops of machine building, furniture and several other production sectors. The main direction of improving the use of production capacities is increasing the share of fixed production sectors in the whole production area through reduction of areas of auxiliary services, compact location of equipment and workplaces and installation of equipment of higher productivity, reduction of areas for transportation facilities and passages (in conformity with existing norms of safety techniques and working conditions).

Drafts of the production and construction plan should be interrelated. In their development, it is first necessary to determine maximum capability of production output of existing capacities and then questions connected with the construction of new enterprises and allocation of capital investment for it. This will make it possible to ensure the necessary level of production output with a relatively smaller size of capital investment compared to when it is allocated to ministries in general for new facilities without any tie-in to possible increase of production for existing enterprises. This is why

analysis of the dynamics of capacities compared to growth of production output as well as questions of availability, startup and retirement and age structure of equipment is very important.

In comparing the balance of production capacities, it is necessary to take into consideration changes in production. The initial factor is determination of capacity for the beginning of a period, on the basis of which growth of production capacity is calculated as the result of the influence of various factors: startup of capacities from the construction of new and expansion of existing enterprises; modernization of existing enterprises; reequipment of existing enterprises and implementation of other organizational and technical measures; change of product mix; reduction or increase of labor intensiveness of products.

It would be wrong to consider an increase in production volume as a consequence of implementation of organizational and technical measures for the attainment of planned or approved capacities as growth of production capacity because these capacities were taken into account at the time they went into operation. Planned capacities are used for existing production capacities of enterprises, shops and so forth in the assimilation stage.

In case of a change in the products list compared to that specified by the plan, production capacity is recalculated according to prescribed procedure. After this, a determination is made as to how much capacities were reduced in connection with retirement of equipment and how change in production labor intensiveness, scheduled amount of worktime and turnover and sale of fixed capital affected capacity.

For integrated planning of production and construction, it is necessary to determine production capacities without taking into consideration limitations due to so-called bottlenecks and to disclose possible reserves for their use. While this question appears to be simple, let us examine it.

By production capacity of an industrial enterprises, as it is indicated in instructions for the working up of yearly balances of production capacities of existing industrial enterprises, is meant maximally possible annual production output or volume of processing of raw materials in the products list and assortment put out in a given year with the full utilization of equipment and production capacities. At the same time, the employment of this formulation in practice leads to two quite different understandings of production capacity: full production capacity and available production capacity.

Full production capacity of an industrial enterprise should be taken to mean maximally possible annual production output of the products list and assortment provided by the plan (or actual output--for reporting) in the case of full use of fixed technological equipment and production capacities of basic shops, sectors and units without regard to bottlenecks on the basis of the calendar amount of time in continuous production operations and a two-shift work regime in round-the-clock production operations (or three-, four-shift regimes in those of them where this is provided by operating work schedules).

The available production capacity of an industrial enterprise is taken to mean maximally possible annual production output for the products list and assortment provided by the plan (or actual output--for reporting) in the case of full utilization of fixed technological equipment and production capacities of basic shops, sectors and units while taking into account actually carried out measures for the elimination of bottlenecks in the given period and actually existing work schedules.

Both concepts stem from the above-indicated general definition depending on what equipment and what amount of worktime are used in calculations of capacities.

In instructions for accounting of capacities it is specified that they must be calculated according to the capacity of basic production shops, units and sectors whose list is established in sectorial instructions for the determination of production capacities of enterprises while taking into account the implementation of measures for the elimination of bottlenecks. Reference to the need for the latter, on the one hand, points as it were to calculation of full capacity and, on the other, does not concretize what amount of time and what capital investment, material resources and organizational and technical measures would be required for the elimination of the bottlenecks.

Actually, this is a compromise decision. If limitations in production due to the existence of bottlenecks are completely excluded, then the production capacity of an enterprise should be calculated on the basis of the fixed equipment of basic shops, sectors and units; if the available capacity is to be determined, then it is necessary to introduce limitations due to the inadequate production capabilities of an enterprise's individual sectors.

The terms full and available production capacity also differ as to amount of available time. Enterprises with discontinuous production whose leading shops work two shifts (or less than two shifts) must make their calculations of production capacities on the basis of two-shift operation. But actually this principle is not always maintained, and in a number of cases capacities are determined on the basis of actual shift operation.

In practice, enterprises and sectorial scientific-research institutes endeavor to calculate available production capacity on the basis of the installed equipment park, with bottlenecks being taken into consideration. Such a desire is fully understandable. Calculations of capacity constitute one of the most important elements of validating feasibility in an industrial production plan, and enterprises try to have them shown in the smallest sizes so as to prevent the imposition of an unrealistic production program. Such occurrences are evidenced by a comparison of the extent of use of capacity on the basis of data of balances with correlations of actual and normative operational shift coefficients of equipment for individual machine-building ministries.

Machine-building is a sector with a two-shift regime of operation where (taking into account that a portion of the equipment is in reserve and in planned maintenance and a portion of the equipment (up to 25 percent) must be

operated during the third shift) the shift coefficient must be about 1.7. With full use of existing production capacities, the actual shift coefficient should be close to the norm. But in balances of production capacities worked out by the ministries, a high level of use of capacities is shown in many

| | Actual operational shift coefficient of metalworking equipment of basic production in 1982 | Ratio of actual shift coefficient to norm (1.7), % | Percentage of capacity use based on calculations of balances of production capacities in 1982 |
|---|---|---|---|
| Ministry of Power Machine Building | 1.38 | 81 | 88 |
| Ministry of Chemical and Petroleum Machine Building | 1.40 | 82 | 90 |
| Ministry of Machine Tool and Tool Building Industry | 1.32 | 78 | 88 |
| Ministry of Instrument Making, Automation Equipment and Control Systems | 1.45 | 85 | 91 |
| Ministry of Construction, Road and Municipal Machine Building | 1.34 | 79 | 87 |
| Ministry of Machine Building for Light and Food Industry and Household Appliances | 1.34 | 79 | 86 |

cases with a relatively low shift coefficient. According to data of daily observation carried out by the USSR Central Statistical Administration on 19 May 1982, the actual shift operation of metal-cutting machine tools in basic production was 1.39 and that of forging and pressing equipment--1.44. Capacity use under these conditions cannot exceed 83 percent and when taking account of downtime--74 percent. At the same time, for most machine-building ministries, the percentage of used capacities turns out to be higher (see Table).

As we see, the enterprises of these ministries still have significant capacity reserves which can be put into operation by boosting the shift work of equipment. In order not to allow lowering of production capacities, it is necessary to compare data on actual and normative shift coefficients of operation of equipment. The normative shift coefficient has to be set either on the level of the plan or for old enterprises on the level of coefficients adopted in plans for the construction of similar production facilities. It is possible to use data for control characterizing equipment load in the course of a shift in machine-hours. It is defined as the ratio of estimated time of operation of installed equipment in one shift in man-hours to its average day

amount. Such a method is based on the assumption that equipment carries a 100-percent load during a shift. Of crouse, in practice there is always downtime. For this reason there should also be an additional comparison of data on the actual number of hours of equipment operation with data of one-time daily observations of its use conducted by the USSR Central Statistical Administration.

In our opinion, it is useful to calculate capacities in two variants: while taking into account weak spots (as is done in practice at the present time) and without taking them into account. The second variant is of special importance in comparing five-year plans and plans for longer periods of time when strategic questions of development of both industry as a whole and of its sectors are being solved. In calculations of capacities without taking weak places into consideration, it is necessary to determine for the planning period the need for additional capital investment, equipment, materials and measures for expanding cooperation for each enterprise. The output of additional production as a result of this and the necessary investment should be compared with outlays for the attainment of output of the same production through construction and startup of new production capacities. This will make it possible to select a more economical path of production development.

Timely assimilation and full use of the planned capacities of new enterprises and facilities is of major importance. In industry, quite a bit of experience has been acquired in rapidly achieving planned indicators. It is possible to cite by way of example such a large complex as the Volga Motor Vehicle Plant imeni 50-Letiye Oktyabrya. Capacities are being assimilated on and ahead of schedule at many instrument-making, ferrous-metallurgy and other facilities. For the purpose of studying progress of assimilation of new enterprises and facilities the USSR Central Statistical Administration has been conducting special surveys since 1963. The survey materials show that at many facilities capacities are late in being assimilated. Because of this, the national economy each year gets millions of rubles less of production.

With slow assimilation of planned capacities at new enterprises and facilities, expanded monetary, material resources and manpower resources do not produce the necessary effect, which results in tremendous losses to the national economy. The startup and utilization of the planned capacities of a new enterprise (facility) are the culmination of a long and complex process, the basic stages of which are planning, construction and particularly the process of utilization of production in the course of which all the accumulated deficiencies are disclosed.

Analysis of the causes of nonassimilation and incomplete utilization of planned capacities shows that the basic reasons are equipment defects, mistakes in plans, shortage of qualified cadres and, an insufficient amount of raw and other materials and equipment defects.

It is necessary to increase the responsibility of supplier machine-building enterprises for the quality of produced equipment and of clients for acceptance and putting it into operation.

A supplier plant must deliver machines and mechanisms in accordance with an approved plan and be responsible for ensuring their planned productivity. It isnecessary to pay only a part of the cost of delivered equipment (approximately equal to 90 percent) and the final payments for it should be made after attainment of their planned (passport) indicators. Another solution is also possible: if a machine tool or unit cannot attain planned productivity (and this is acknowledged by the manufacturing plant or by arbitrage), the client is compensated for the losses he has suffered.

One of the most important ways of increasing the effectiveness of capital investment, accelerating construction time and assimilating new production capacities is upgrading the quality of planning. The technical and economic indicators of new enterprises and facilities depend to a considerable extent on how carefully thought out and exact solutions included in the plan are and to what extent they are in conformity with the achievements of science and technology.

There are frequent instances where plans include outdated production equipment, inadequate mechanization of labor-intensive operations, as well as that of intraplant and intrashop transport and materials handling operations. As a rule, questions of organization and utilization of production are pootly worked out in plans. They are solved on the basis of initiative of plant technical and economic services. Up to the present time, planning organizatins have not assumed the responsibility for timely utilization of quantitative and qualitative indicators of the facilities planned by them. The role of planning organizations, which even during the construction process is limited only by the designer's supervision, and their responsibility for the quality of plans and timely starting up of new enterprises and facilities needs to be significantly increased. They must take an active part in progress of construction and starting production at new facilities. Moreover, it is necessary to establish norms of administrative and material responsibility for difficulties in starting facilities arising through the fault of planning organizations as well as measures of material incentive for good quality of plans providing for adjustment of equipment and getting enterprises to operate at full planned capacity in a time period designated by norms.

Any alterations of design and technological documentation of a facility after it has gone into operation must not only be done without compensation by the respective project-planning organizations but also be reflected in their income and level of material incentives. It is necessary to work out more carefully than is being done at the present time a complex of measures for organizing planning and management of production down to intraplant operative planning. Normative time periods of mastering production should be designated in plans, and project-planning organizations should have the responsibility for their right determination and for ensuring utilization of facilities on schedule to the degree that this depends on the quality of the project plan.

The calculation and payment of bonuses to personnel of project-planning organizations are done on the basis of an estimated economic effect following approval of the documentation without take into account the real quality of the project and actual volumetric and qualitative indicators of operation of

enterprises and facilities, which are revealed only after they have gone into operation. Cases are known of startup of facilities which cannot provide work at the planned level because of construction deficiencies. This condition must be changed: at the very least half of the bonuses should be paid while taking into account verification of the quality of the project plan in the process of operation and actual effectiveness of production. In the case of disclosure of defects in the project plans, the second half of the bonuses would not be paid and in necessary cases the earlier received portion of them should be recovered.

For the purpose of reducing errors of project planners, a carefully worked out technical plan (technical assignment) is necessary, which would be approved by a group of highly skilled specialists. It should be adhered to at all stages of construction and must not be changed for the benefit of local interests and theimmediate interests of builders, frequently under the pressure of superior organizations.

The creation of new and modernization of existing facilities frequently drags on for a long time. And this results in the fact that by the time of startup of a facility the specifications of the basic product are changed compared to those provided in the project plan and timely manufacture of special tools and technical accessories as well as of special and nonstandard equipment is made difficult.

But the chief deficiency is incorrect determination in planning documentation of the composition of priority complexes. In many cases, they do not include all that is required for the normal functioning of the capacity of auxiliary facilities.

Construction and installation organizations basically receive bonuses for the time of turning over facilities. Builders have no interest in speeding up the startup of new facilities. This is why cases are so numerous of startup of facilities with construction flaws in workmanship, which interfere with their functioning and do not allow assimilation of planned capacities in normative time periods. It would be useful to provide indicators in the system of issuing bonuses to builders that are cannoected with how the assimilation of capacities put into operation is secured. It possibly would be advisable to include as part of acceptance commissions representatives of sectorial departments of Gosplan USSR and gosplans of union republics.

The procedure for acceptance of facilities should be made more strict, and only those should be accepted which not only have started to put out products in accordance with norms of assimilation but also can in norm-prescribed time periods ensure their output at the planned level. Possibly the right should be granted to financing banks to deduct from the client (building contractor) a fine in case of violation of the procedure for acceptance of facilities for operation in the amount of 1.0-1.5 percent of estimated cost of construction with assignment of these sums to the results of the operational activity of enterprises. It is also necessary to change the existing procedure according to which acceptance documents for facilities received for operation in the reporting year are approved the following year, since because of haste this results in turning over facilities with flaws in workmanship.

Scheduled assimilation and full use of production capacities largely depend on timely cadre training. Frequently, enterprises and facilities accepted for operation are technically in a position to operate at the planned level, but there is a shortage of qualified workers and engineering and technical personnel. In consequence, the enterprise (shop) operates only one shift, although the plan provides a two-shift operational regime. The reasons for this lie either in the fact that appropriate measures were not adopted in time for training of personnel or because of lack of housing for personnel due to unintegrated construction of an industrial facility. The construction of dwellings, trade and municipal and personal service enterprises should in necessary cases be included in the priority complex and be provided with the required capital investment in a centralized manner rather than in the procedure of deductions for share participation. These questions should be resolved in the course of working out planning estimates.

An essential condition of full utilization of production capacities is the observance of right relationships in the development of individual sectors and production operations, in other words, of realization of the requirements of the law of proportional development of the socialist economy. But this condition is not always observed, particularly in sectors processing agricultural raw materials--the light and food industry, in machine building (in connection with pressure of the balance of ferrous metals) and in individual production operations of the chemical industry.

By the time of takeover for operation, the facility should be staffed with personnel and have everything necessary for normal functioning: raw and other materials, a stock of parts, energy resources, accessories and equipment ready for operation that have been tested under different operational conditions. Given these conditions, the mastery of a faciity will not take much time, although in accordance with existing norms unjustifiably long periods of time are frequently designated. Many facilities attain planned capacity for production output ahead of prescribed normative time periods. Cases are not rare where capacities are assimilated in the course of a month following acceptance of a facility for operation, although the prescribed time periods amount to a year or a year and a half.

The analysis of production capacities of associations and enterprises for production output should be supplemented by an analysis of the economic factors involved in the use of capacities. The fact is that it is important to analyze not only the amount of manufactured products but also the economic conditions of their pro ction and their influence on the use of capacity for putting out products. Among these factors, a significant role is played by outlays on production output. If they are more than socially necessary recognized at the time of price setting), then obviously the question of feasibility of their use calls for special examination. The maximum possible manufacture of products (let us recall that this is the chief element in determination of capacity) is not always economically profitable. If in this connection the cost of products at the enterprise exceeds socially necessary expenditures for their production, it would then be more advantageous to spend funds on reequipment and modernization or on new construction than to bear every year large production and transport expenses. In 1933, fixed capital

with a total value of 6.5 billion rubles was used in industry whose service life had expired. In view of the use of obsolete equipment of low productivity in industry, there are employed several hundred thousand extra people. Moreover, the replacement of this equipment with retention of the same production value requires one-time labor outlays that exceed only slightly the annual overexpenditure of manpower resources.

One of the most important problems of the general economic conditions concerning the use of capacities is that of developmental balance and proportionality of sectors of the national economy and intrasectorial production operations. In recent years, the degree of use of capacities in a number of sectors has shown a tendency for reduction, particularly because of a deterioration in the availability of certain types of raw materials, for example metal, nonrelatedness in the development and utilization of capacities in interrelated production operations, particularly in the chemical industry and an insufficient number of workers. At the same time in certain production operations there are more capacities than needed if one proceeds from the existence of raw-material resources (such a situation, for example, has come to exist in primary processing of flax). For this reason it is necessary to study not only factors dependent on enterprises but also the general economic situation in the country on the macrolevel.

The question of an optimal level of use of production capacities requires theoretical and practical working out. It would be incorrect to assume that it should equal 100 percent in all cases. The question of the optimal-use factor of capacities is a part of a more general problem--that of the economic side of their determination and employment.

For normal development of the national economy,certain reserve capacities are required, which is dependent on a number of circumstances. In the course of plan fulfillment, separate discrepancies and disproportions arise. For their elimination, it is not enough to have reserves of commodity stocks; it is necessary to have possibilities for maneuverability in production with the means of free capacities. Thus in years of drought, it is necessary to cover reduction of hydropower with the power of thermal stations. This means that it is necessary to have reserve capacities not only for the production of electric power at thermal stations but also free capacities for the production and transportation of coal, petroleum and gas and for the production of black oil. In the opposite case, limitations are inevitable in the supply of electric power both for production and for municipal and personal needs. Without a reserve of production capacities, it is impossible to secure the introduction of new types of products, which as a rule are more complex, requiring time for finishing and adjusting.

It is necessary to work out planned standards of use of the production capacities of existing enterprises for all sectors both with a discontinuous and with a continuous process of production. Optimal degree of use of capacities employed in the compilation of plans of economic and social development should be differentiated by sectors and production operations. Normative coefficients worked out for sectors and production operations make it possible to significantly improve planning and will serve as an objective criterion for assessment of operation of enterprises.

Let us point out that labor productivity at newly operational enterprises and facilities is higher than for those that were commissioned earlier. Thus at enterprises and facilities that became operational in industry during the 10th Five-Year Plan, production output per worker is almost twofold that of capacities existing at the beginning of the 10th Five-Year Plan. Such a situation was also formerly observed. This characterizes the measure of influence of scientific-technical progress--a basic indicator of economic effectiveness. Taking into consideration that the growth rate of labor production, this chief gauge of improved production efficiency, is not enough, it becomes necessary to revise criteria of efficiency of planned facilities, that is, the level of productivity at them should be threefold higher than that which has been achieved. The rise of requirements on project plans will contribute to the coordination of the number of workplaces at new capacities with labor resources and growth of production efficiency.



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CSO: 1820/35

REGIONAL DEVELOPMENT

## MOLDAVIAN OFFICIAL TRACES REPUBLIC'S DEVELOPMENT

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 9, Sep 84 pp 7-14

[Article by I. Ustiyan, chairman of the Moldavian SSR Council of Ministers: "Years of Creation (on the 60th Anniversary of the Establishment of the Moldavian SSR)"]

[Excerpt] The economy of the Moldavian SSR acquired new features during the first half of the Sixties. The branch structure of Moldavia's industry began to change in favor of a rapid increase in the proportion of the machine-building and power sub-branch groups. This was connected with the general laws in the development of the USSR economy and with the task of increasing the republic's industrial potential under the distinctive conditions of the formation of its national economy. It is significant that whereas the output of products increased 2.1-fold during 1959-1965 in the Moldavian SSR's industry and 1.5-1.9-fold in the food and light industries, it was 3-6.8-fold in the power, chemical, rubber, asbestos, and building material industries. Production volume grew almost 6.2-fold in machine building and metal working, including 14-fold in machine building.

A total of 55 large industrial enterprises and 200 shops were commissioned in the republic during 1959-1965.

The commissioning of the first phase of the Moldavian GRES [State Regional Electric Power Station] was a sharp leap in the expansion of electrical power in the republic from 751.2 million kilowatt hours in 1961 to 3.11 billion kilowatt hours in 1965. The transition to the establishment of the Moldavian SSR Power Grid, which was connected by electric power transmission lines with the Southern Interconnected Power System, was carried out during these years. The improvement of the republic's power system was a key factor in the further transformation of the economy, in the qualitative changes in the equipment and organization of production processes, and in increasing labor productivity.

The process of internal differentiation and the formation of independent sub-branches began in machine building during this period. Article and specialized enterprises, which were related to branches whose products had not been produced before in the republic (instrument making, tractor and pump building, etc.), were commissioned; and the rates of development of the

power industry (electrically powered machines for production use, household items, and electrotechnical materials) grew. Article specialization was intensified based on their expansion and reconstruction. In machine building, Moldavia planned a sharp transition to the production of complicated and labor-intensive items which required high skills. This helped to limit the importation of metal and other materials and contributed to the fuller use of the republic's labor resources.

During this same period, agricultural production underwent considerable changes. The average annual production of sugar beets during 1961-1965 exceeded the 1940 level by more than 15-fold; of tobacco -- by more than sevenfold; of vegetables -- fourfold; and of grapes -- almost twofold. On the whole, the gross output of agricultural products during 1965 exceeded the 1940 level 2.44-fold.

Thus, an accelerated development occurred during the first half of the Sixties primarily in those branches of the ecomony, which had the most favorable natural and economic conditions, in order to use the republic's resources more effectively and to combine its interests with the country's interest in general.

The party's agrarian policy, which was developed during the March 1965 CPSU Central Committee Plenum, marked the beginning of a new stage in the development of agriculture and put into operation large reserves for increasing the output of agricultural products. A steady trend in the growth of agricultural product marketability was fixed. This was caused by the deepening specialization of the farms and by a significant growth in the production of industrial crops, vegetables, fruits, and grapes.

This, in turn, required the building up of the processing industry's capabilities. Its fixed production capital was increased 1.8-fold, and industrial production volume -- 1.3-fold. A total of 46 plants and workshops were constructed and commissioned. Large enterprises: canning -- with a capacity of 70-100 million jars a year ; sugar -- with a capacity for processing 3,000 tons of beets a day; and winemaking -- for processing 300-500 tons of grapes a day, were commissioned.

The power industry, machine building, metalworking, building materials industry, and the furniture and woodworking industry continued to be expanded at high tempos.

The rate of growth for the overall production of industrial products during 1966-1970 reached 157 percent for the republic as a whole (1965 = 100 percent),including the power industry -- 254 percent; machine building and metalworking -- 217 percent; the furniture industry -- 193 percent; the building materials industry -- 176 percent; light industry -- 202 percent; and the food industry -- 128 percent.

The growth in scope and the qualitative structural changes for the better in the republic's economy imposed new and higher demands on management. One of the main ways to improve the management of the economy during 1970-1975 was the formation of new and more improved management structures and the further carrying out of production concentration by means of creating industrial and scientific industrial associations and combines.

By the end of 1975, production and scientific and production associations and combines numbered 69 in the republic's industry. These produced approximately 50 percent of the gross output of industry, and in such branches as food -- 72 percent; local -- 80 percent; and meat and dairy -- 65 percent.

During this same period, more than 60 new industrial enterprises and works were constructed and commissioned in the republic's industry and important steps were taken to reconstruct, technically reequip, and incorporate into production the latest achievements of science and technology.

The leading branches of industry were developed at high rates. The volume of output of the power industry increased 1.8-fold and that of machine building and metalworking -- twofold, including instrument making -- 3.6-fold. The output of light industry grew 1.6-fold and that of the food industry -- 1.4-fold.

Under the favorable influence of the CPSU agrarian policy and as a result of the carrying out of large-scale concentration and the deepening of specialization in agricultural production, the dynamic and proportional development of production forces was insured in the republic, the agricultural production base was considerably expanded, and its economic structure was strengthened.

The republic's national economic complex moved to a new and higher level of social production during the years of the 10th Five-Year Plan. National income was increased 1.3-fold, the output of industrial products grew by 32 percent, and the average annual gross output of agricultural products -- by 13 percent. Labor productivity was increased in industry and in agriculture.

The branches, which determine scientific and technical progress in the national economy, were developed at the highest rates. The output of machine building and metalworking increased 1.7-fold. The republic's power base improved significantly. The installed capacity of the power system grew 1.3-fold and reached 2.9 million kilowatts, and the output of electrical energy increased by 14 percent in comparison with 1975.

The branches, which satisfy the population's need for consumer goods -- the food, light, furniture, woodworking, and local industries, became much more powerful.

In the republic's national economy, the scales for introducing new equipment grew and the technical level of production increased during the years of the 10th Five-Year Plan. The proportion of products with a state Seal of Quality in the overall production volume grew from 3.2 percent in 1975 to 13.8 percent in 1980.

During this period, more than 3.6 billion rubles of capital investments were directed toward the republic's agriculture (for the entire complex of operations). This permitted the material and technical base of the branch to be strengthened considerably. The electrical power supply per job, calculated per one worker, grew more than 1.6-fold on the kolkhozes and sovkhozes.

New animal husbandry complexes were built, the capacities of poultry plants were increased, approximately 77,000 hectares of irrigated land were put into operation, and warehouses for mineral fertilizers were mechanized. New fruit warehouses and enterprises for repairing agricultural equipment were built and existing ones were expanded.

At the same time, large steps were taken to specialize and concentrate production on the basis of inter-farm cooperation and agro-industrial integration and to incorporate the achievements of science into production. All of this permitted the sale of grain to the state to be increased by 618,000 tons in comparison with the 9th Five-Year Plan; of sugar beets, fruit, grapes, and vegetables -- by 4 million tons; of cattle and poultry -- by more than 304,000 tons; and of milk -- by 925,000 tons.

Capital investments consisting of 36 million rubles more than during the 9th Five-Year Plan were directed toward the expansion of transportation and communications during the five years. The technical equipment of motor vehicle enterprises and river wharfs was improved, the length of motor vehicle roads with a hard surface grew, and the expansion of a number of railroad hubs, the radio and television broadcasting network and international communications lines was carried out. Freight shipments by motor vehicle, river, railroad, and air transport grew by 25 percent, and the output of communications -- by 1.4-fold.

The construction program was successfully realized during the 10th Five-Year Plan. A total of 7.4 billion rubles of capital investments were directed toward the republic's national economy. Fixed production capital was significantly expanded and modernized. A total of 36 large enterprises were put into operation.

Based on the dynamic and proportional development of the material production sphere, important social measures were carried out, real per capita income grew by 20 percent, and payments and benefits from public consumption funds increased by more than a third.

A total of 7.3 million square meters of housing were built and commissioned during the years of the 10th Five-Year Plan. Approximately 600,000 people

moved into new apartments and improved their housing conditions. Large-scale town-building work was also carried out, and the architectural appearance of the republic's cities and villages was improved. The network of urban electrical transportation was expanded, and steps were taken to improve the supplying of the population with water, gas, heat, and electricity.

The service area was expanded further. The retail goods turnover of the state and cooperative trade system grew by almost a third. The volume of everyday services for the population increased by more than 1.5-fold, and more than 100 domestic services installations were commissioned.

During 1976-1980, new frontiers in the area of education, culture, health care, athletics, and sports were achieved in the Moldavian SSR. General educational schools and pre-school establishments with almost 150,000 places were built in the republic. The student contingent in extended-day schools increased 1.6-fold. The vocational and technical schools trained 154,000 skilled workers, and the higher and secondary specialized training institutions-- approximately 115,000 specialists. The network of libraries for the masses, club establishments, cinema units, theaters, and concert halls was expanded. A great deal was done to expand health care.

Important work was performed to protect the environment and to use natural resources rationally. Approximately 130 million rubles of capital investments were directed toward environmental protection measures.

A number of measures to improve planning, reorganize the management of industry and construction, improve the centralized direction of the national economy and expand the rights and independence of enterprises and organizations were carried out in the republic during these same years. Scientifically sound schemas for managing industrial branches were developed. The role of labor collectives in solving social and economic questions was increased.

In general, the results of the 10th Five-Year Plan testify that the republic's economic, scientific and technical potential has become a powerful and stable base for solving even larger scale tasks in the economic and social development of the Moldavian SSR during the 11th Five-Year Plan and in the more distant future.

Just as the successes of communist construction in the country as a whole, these successes have been primarily caused by the uniting of the national economies of the union republics into a single national economic complex that permits qualitatively new public production forces, which significantly exceed the simple total of union republic production forces, to be created.

The diversity of the inter-republic economic ties and the international unity of all of our country's workers are corroborated by the experience in building enterprises for the different branches of industry in our republic. Thus, for example, the entire country -- approximately 500 enterprises in

all union republics -- erected the Moldavian GRES, the flagship of the republic's power industry. The friendship and cooperation of all Soviet peoples and the creativity of the Leninist CPSU nationality policy are being demonstrated with special force on these construction sites.

The following facts, for example, testify to the intensity of the development of production economic ties in the national economy of the USSR. The Moldavian SSR alone receives products from 100 branches in the fraternal union republics and sends them products from 67 branches.[1] Reciprocal deliveries connect the Moldavian SSR national economic complex with all union republics and the country's economic rayons from which come oil, coal, iron, steel, ferrous metals, plastics, cloth, yarn, machine tools, machinery, equipment, and instruments.

Specialization and cooperation -- these are some of the distinctive features of inter-republic economic bonds during the present stage. The problem of creating communism's material and technical base requires the rational use of each republic's economic potential and the expansion of exchanges of material valuables, progressive experience and personnel.

In the all-union division of labor, Moldavia is emerging as an important producer of products in the agro-industrial complex. The following are related to the branches of all-union specialization: In agriculture -- the production of grapes, fruits, vegetables, sun flowers, ester oil crops, tobacco, and sugar beets; in the food industry-- wine-making and the preserve, meat and fat, ester oil, tobacco, and sugar branches.

A significant portion of the products, which are produced in Moldavia, is delivered to other union republics-- approximately 84 percent of the fruit and vegetable preserves, 80 percent of the cognac, 43-48 percent of the sugar and vegetable oil, and approximately 60 percent of the wine.

The industrial consumer goods, which are produced by the republic's enterprises, occupy no small place in deliveries to the country's different economic rayons. Clothing, knitted and hosiery items; footwear; fur articles; silk and cotton cloth; leather haberdashery items; textile haberdashery items; lace curtain items; and toys valued at hundreds of millions of rubles are exported.

Items from the electrical engineering industry, instrument making and precision machine building occupy an ever larger percentage in the deliveries of industrial products by the union republics.

Actively participating in the all-union socialist competition to fulfill the state plan for the economic and social development of the USSR successfully, the workers of the Moldavian SSR have achieved new successes in expanding the national economy during the first three years of the current five-year plan. The volume of industrial production has increased by 20 percent, and labor productivity in industry -- by 15 percent.

The machine-building branches, which determine scientific and technical progress throughout the republic's economy, as well as the food and light industries were expanded at the highest rates during these years. A new branch of industry -- the metallurgical one -- was established. The Moldavian Metallurgical Plant in the city of Rybnitsa will provide its first smelting during the jubilee year.

Measures are being carried out to intensify agricultural production, use the land rationally, and incorporate industrial technologies and the collective contract on a broad basis in the village in accordance with the decisions of the 26th CPSU Congress, the 15th Moldavian Communist Party Congress, and the May 1982 CPSU Central Committee Plenum.

A considerable amount of equipment, mineral fertilizers, chemical weed and pest killers, and herbicides have been delivered to agricultural enterprises and organizations since the beginning of the five-year plan. New animal husbandry complexes have been constructed, and farms and premises for keeping cattle and poultry have been mechanized.

During the past three years of the five-year plan, the yield (average annual quintals per hectare) reached: of grain -- 31.4; of fruits and berries -- 72.7; of vegetables -- 158; of grapes -- 71; of sun flowers -- 17.3; and of sugar beets -- 218. The average annual yield of milk from one cow in the public sector exceeded 3000 kilograms last year; the egg production of laying hens -- 200 eggs; and wool clippings from one sheep -- 2.2 kilograms.

On the whole, the output of agricultural products per 100 hectares of agricultural land reached 121,000 rubles.

The establishment of a qualitatively new production and organizational structure for the agro-industrial complex permitted the role of the republic in the implementation of the country's Food Program to be increased noticeably. The volume of industrial output in the branches of the food industry grew by 25 percent during the last three years.

The food industry branches last year produced 1.619 billion standard jars of fruit and vegetable preserves, 45.7 million decaliters of wine, 403,000 tons of granulated sugar, 106,000 tons of vegetable oil, 99 tons of natural ester oil, more than 179,000 tons of meat, and 364,000 tons of whole milk products. Other branches in the republic's national economic complex: construction, transportation, communications, trade, every day services, material and technical supply, and procurement, were also expanded dynamically during these years.

When describing the dynamic growth of the republic's economy (Table 1), it is necessary to point out that the powerful rise in the entire national economy of the Moldavian SSR was possible only within the country's unified national economic complex.

Table 1.

| (2) Показатель | (1) Год 1924 | 1940 | 1960 | 1970 | 1980 | 1981 | 1982 | 1983 | 1984 (план) (3) |
|---|---|---|---|---|---|---|---|---|---|
| (4) Валовой общественный продукт, % | - | - | 100 | 230 | 409 | 414 | 461 | 491 | 509 |
| (5) Произведенный национальный доход — всего, % | - | - | 100 | 223 | 355 | 356 | 410 | 433 | 456 |
| в расчете на душу населения | - | - | 100 | 186 | 268 | 266 | 304 | 319 | 332 |
| (6) Вся продукция промышленности (1924 = 1) | 1 | 14 | 124 | 343 | 702 | 714 | 778 | 841 | 871 |
| (7) Валовая продукция сельского хозяйства, % | - | 100 | 172 | 280 | 353 | 331 | 403 | 403 | 426 |
| (8) Отправление грузов (автомобильным и железнодорожным транспортом), млн. т | 0,18 | 2,6 | 79,7 | 181,7 | 295,6 | 228,3 | 321,9 | 325,5 | 331 |
| (9) Ввод в действие основных фондов, млн руб. | - | 8 | 343 | 942 | 1 425 | 1 407 | 1 530 | 1 550 | 1[illegible] |
| (10) Численность рабочих и служащих в народном хозяйстве, тыс. чел. | - | 101 | 439 | 944 | 1 511 | 1 557 | 1 579 | 1 605 | 1[illegible] |

Key:

1. Year
2. Indicator
3. Plan
4. Gross public product, percent
5. Produced national income, percent; calculated on a per capita basis
6. All industrial products (1924=1)
7. Gross agricultural production, percent
8. Dispatch of goods (by motor vehicle and railroad transport), millions of tons
9. Commissioning of fixed capital, millions of rubles
10. Number of workers and employees in the national economy, thousands of persons

The development of the material production area and its intensification are permitting the social program, which is aimed at improving the workers' prosperity, to be implemented successfully (Table 2).

Just as throughout the country, the transition to a mandatory universal secondary education is being carried out in the republic, the reform of general educational and vocational schools, which is being carried out in the country, is helping to raise the quality of training and indoctrination and to improve the labor education and professional orientation of youth radically.

The party's Leninist nationality policy, the concern of the Soviet state and the fruitful friendship of the peoples of our country have assured the flourishing of Soviet Moldavia's science, education and culture.

Table 2.

| (2) Показатель | (1) Год 1924 | 1940 | 1960 | 1970 | 1980 | 1981 | 1982 | 1983 | 1984 (план) (3) |
|---|---|---|---|---|---|---|---|---|---|
| (4) Товарооборот государственной и кооперативной торговли (1940=1) | - | 1 | 5 | 12 | 24 | 25 | 25 | 26 | 27 |
| (5) Общая (полезная) площадь городского жилищного фонда, млн. м² | 0,3 | 2,0 | 6,1 | 12,0 | 19,4 | 20,4 | 21,3 | 22,2 | 22,5 |
| (6) Количество общеобразовательных школ, ед. | 126 | 1864 | 2569 | 2155 | 1797 | 1764 | 1738 | 1687 | 1689 |
| (7) Численность учащихся в них, тыс. чел. | 14 | 440 | 545 | 790 | 736 | 735 | 736 | 737 | 740 |
| (8) Количество средних специальных учебных заведений, ед. | 2 | 22 | 32 | 46 | 51 | 51 | 51 | 52 | 52 |
| (9) Численность учащихся в них, тыс. чел. | 0,4 | 4,1 | 17,1 | 51,7 | 58,9 | 59,3 | 59,1 | 59,2 | 60,5 |
| (10) Количество высших учебных заведений, ед. | - | 6 | 6 | 8 | 8 | 8 | 8 | 8 | 9 |
| (11) Численность студентов, тыс. чел. | -. | 2,5 | 19,2 | 41,8 | 51,3 | 52,6 | 53,3 | 53,3 | 54,7 |
| (12) Численность врачей всех специальностей, тыс. чел. | 0,05 | 1,1 | 4,3 | 7,4 | 12,6 | 13,1 | 13,8 | 14,3 | 14,8 |
| (13) Количество больничных коек, тыс. шт. | 0,1 | 6,1 | 22 | 35,9 | 48 | 49 | 49,4 | 50,2 | 50,7 |

Key:

1. Year
2. Indicator
3. Plan
4. Goods turnover in state and cooperative trade (1940=1)
5. Total (useful) area of housing assets, millions of square meters
6. Number of general education schools, unit
7. Number of pupils in them, thousands of persons
8. Number of secondary specialized education institutions, unit
9. Number of pupils in them, thousands of persons
10. Number of higher education institutions, unit
11. Number of students, thousands of persons
12. Number of doctors in all specialties, thousands of persons
13. Number of hospital beds, thousands of units

The works of Moldavian scientists in the areas of solid-state physics, higher algebra, semiconductor technology, electric spark machining of metals, genetics, biology, biochemistry, history, and linguistics are known not only in our country but also abroad.

Hundreds of scientific developments are being incorporated into the republic's national economy at the direct orders of enterprises and organizations. Many of them have been patented in such countries as the United States, the FRG, France, Sweden, and Japan.

Specialists in more than 200 specialties are being trained for the national economy in 9 higher and 52 secondary specialized training institutions. And this in a kray where there was not a single higher educational institution before the Soviet authorities and where only one out of 10 people were able to read and write. Now, the Moldavian SSR not only satisfies the growing needs of its national economy and science for highly qualified personnel but also prepares specialists for the foreign countries of Asia, Africa and Latin America.

The Moldavian people have long since been famous for the talents which received every opportunity for all-round development and professional growth only under the conditions of Soviet power and the international cultural exchange between the peoples of the Soviet Union. Writers Ye. Bukov and A. Lupan, Heroes of Socialist Labor; I. Bogdesko, people's artist of the USSR; and M. Biyeshu, people's actress of the USSR and Leninist and USSR and Moldavian SSR State Prize winner -- the names of these and many other masters of art are inseparably linked with the formation of the Moldavian people's distinctive culture which is national in form and socialist in content.

Thus, the entire life of the republic is a convincing witness to the powerful creative force of the peoples of the Soviet Union who are united in a single and indissoluble family.

During the jubilee year, the republic's workers are honorably fulfilling their duty, guided by the decisions of the 26th CPSU Congress, the 15th Moldavian Communist Party Congress, and the June and December 1983 and February and April 1984 CPSU Central Committee Plenums; the instructions and recommendations of Comrade K. U. Chernenko, general secretary of the CPSU Central Committee and chairman of the USSR Supreme Soviet Presidium; and by the CPSU Central Committee Decree "On the Work of the Moldavian Communist Party Central Committee To Improve the Style and Methods of the Activity of Party Organizations in Light of the Decisions of the November 1982 CPSU Central Committee Plenum".

Comrade K. U. Chernenko points out: "The spread of economic initiative and creativity at the levels of the economic regions, associations and enterprises is one of the most important state-wide tasks.

"It ... and the question of further strengthening the friendship of our country's peoples are two of the most important foundations of the party's Leninist policy. It is necessary that the capabilities of each republic grow to make an effective contribution to developing the Soviet Union's economy as a single national economic complex."[3]

Approximately 92,000 workers and kolkhoz members and more than 3,430 work shops, sections, brigades, and farms, who have joined in the competition to greet the 60th anniversary of the formation of the Moldavian SSR and the founding of the Moldavian Communist Party, have adopted counter-plans and intend to fulfill production quotas by 12 October 1984.

The planned quota for the growth in industrial production volume during the first six months of the current year has been fulfilled by 103.3 percent; for the sale of products -- by 103.5 percent; and 135 million rubles of them above the plan have been delivered to consumers.

The labor collectives of industrial associations and enterprises are widely incorporating progressive experience and effective ways and means for organizing work and production; they are trying to observe contract obligations strictly; and they are successfully expanding the patriotic movement "All Deliveries to the Fraternal Republics -- On Time and With Excellent Quality".

The republic's agricultural enterprises and organizations have successfully fulfilled the half-year quotas for the production and sale of animal husbandry products. In comparison with the corresponding period of 1983, 13,000 tons of meat, 33,900 tons of milk and 25 million eggs more have been sold to the state. The harvesting of vegetables, fruits and grapes is taking place successfully.

The social program is being successfully implemented along with the development of the material production sphere.

As part of the multinational Union of Soviet Socialist Republics, the Moldavian people are confidently looking into the future. The consistently conducted policy of the Communist Party, which is aimed at insuring peace on earth, strengthening the economic and defensive might of our country and increasing the Soviet people's prosperity in every way possible inspires this confidence in us.

FOOTNOTES

1. N. A. Tikhonov, "Sovetskaya ekonomika: dostizheniya, problemy, perspektivy" [The Soviet Economy: Achievements, Problems, Prospects], Moscow, izd-vo APN, 1984, p 43.

2. K. U. Chernenko, "Narod i partiya yediny. Izbrannyye rechi i stat'i" [The People and Party Are United. Selected Speeches and Articles], Moscow, Politizdat, 1984, p 13.



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GENERAL

## ECOLOGICAL ASPECTS OF ECONOMIC ACTIVITY EXAMINED

Moscow EKONOMICHESKIYE NAUKI in Russian No 10, Oct 84 pp 58-64

/Article by G. Karpova, candidate of economic sciences (Leningrad): "Criteria of Evaluation of the Ecological Aspect of Economic Activity"/

/Text/ The ecological aspect of social development reflects the interaction of society and the natural environment. The nature of this interaction depends on the attained level of development of productive forces and production relations, in particular on the level of maturity of science and the attained degree of its application in the technology and management of production. At the present stage the expansion of the scale of production is accompanied by an accelerated depletion of natural resources and an increase in the entry of production and consumption waste into the environment. Hence its pollution, which, as is well known, has a negative effect on the population's health. Under the conditions of socialism such a situation conflicts with the goal of public production. It specifies measures to improve the natural sphere and to prevent the indicated conflict. The decisions of the 26th CPSU Congress set the task of improving state management and of intensifying control in the area of nature use and environmental protection.[1] A scientific approach to the management of natural environmental protection presupposes a disclosure of objective criteria of evaluation of the ecological aspect of economic activity. In this connection it is important to analyze the currently applied criteria of evaluation of the nature protection activity of enterprises.

Statistical reporting of enterprises on nature protection was introduced in 1974. The enterprise submits a report on the discharge of harmful substances into the air and atmosphere protection measures in the form 2-TP (air) and on the utilization of water resources, pollution of reservoirs and water protection measures, in the form 2-TP (water resources). Current and capital expenditures on nature protection are reflected in the form 4-OS.

With due regard for the applied statistical indicators forms 54-TP and 55-TP containing similar planned indicators of nature protection and an efficient utilization of natural resources were included in the Standard Method of Development of the Technical, Industrial and Financial Plan of a Production Association (Combine) and Enterprise approved in 1977.

The volume of discharge of contaminated sewage and the number of harmful substances discarded into the atmosphere are now the main indicators characterizing the ecological aspect of enterprise activity. In order to serve as criteria of evaluation of the work of labor collectives in the area of nature protection, the discharges of harmful substances into the environment should be correlated with standard discharges.

The discharges of pollutants are standardized on the basis of evaluation of the quality of components in the natural environment, which is made by comparing the actual concentration existing in it with the maximum permissible one. The maximum permissible concentration of a pollutant implies its maximum concentration in $mg/m^3$ in the components of the environment, which does not yet have a harmful effect on man's health.

According to article 9 of the USSR Law on the Protection of the Atmospheric Air, standards of maximum permissible discharges are established at a level at which discharges of pollutants from a specific source and all other sources in a given region with due regard for the prospects for its development will not exceed the standards of the maximum permissible concentration of pollutants in the atmospheric air.[2] Maximum permissible discharges into reservoirs are calculated similarly.

In accordance with the existing Standard Sectorial Instruction a stage-by-stage decrease in discharges of pollutants to the level envisaged by the norms of maximum permissible discharges is allowed. Norms of temporarily coordinated discharges are established for the period of realization of measures included in nature protection plans. Thus, the observance by enterprises of the norms of maximum permissible or temporarily coordinated discharges of harmful substances into the atmospheric air and reservoirs is now the main criterion of evaluation of the ecological aspect of economic activity.

In our opinion, both in practice and theory such a criterion is highly vulnerable. From the practical point of view the reality of the norms of maximum permissible discharges in general and the fact that amounts of discharges are subject to control in particular evoke doubt. At the present level of development of productive forces a general attainment of a standard state of the environment during the planned period cannot yet be considered realistic. The constant expansion of the scale of production, despite the equipment of pollution sources with modern purification systems, does not bring about a reduction in the number of harmful substances in the air, water and soil. Calculations show that only 1.5 to 2 percent of the total volume of a natural substance involved in production becomes the end product consumed by society, while the remaining part goes into waste polluting the natural environment.[3] Things being as they are, without a fundamental change in production technology it is difficult to imagine an exhaustive solution of the ecological problem.

If modern urban agglomerations are discussed, to eliminate the existing level of pollution of the air basin in large cities, it is necessary at least to stop power production and motor traffic in them. It is clear that it is impossible to solve and even to set such a task. Setting admittedly unrealistic tasks in the area of nature protection, as in any other area, for enterprises can only harm this cause. Norms of temporarily coordinated discharges

also hardly ensure the solution of the problem under discussion, because the calculation of the amounts and ingredient composition of the discharges of enterprises is not feasible in practice.

The Standard Sectorial Instruction suggests that the amounts of discharges be controlled, measuring either the discharges themselves, or the actual pollution of the atmosphere. For this the sections in whose direction the flares of discharges of a given enterprise alone spread quite often are determined and a regular sampling and analysis of air samples on stationary and route posts are organized.

The method of direct measurements of discharges is effective only with a constant calculation of their amounts, which will make it possible to record all cases of salvo and unorganized discharges inflicting serious damage on the environment. Such a calculation requires automatic systems, which without a man's participation constantly take samples, make rapid analyses and issue information to processing computer centers. Such systems are effective and necessary if the goal of controlling the state of components of the natural environment is pursued. However, the situation is different when the problem of determining the amounts of discharges is solved. The development of an automatic system of controlling every source of pollution and for every harmful substance would require a volume of capital commensurable with the expenditures on the purification of discharges. For fully understandable reasons the enterprises themselves will hardly inform controlling bodies of salvo and unorganized discharges with the necessary reliability. Most likely, amounts corresponding precisely to maximum permissible (or temporarily coordinated) discharges will appear in their reporting.

The method of measuring the actual pollution of the atmosphere ("method of subflare measurements") is also speculative with respect to an individual enterprise. Harmful substances discharged into air and water basins enter into a reaction with each other, are subject to significant shifts and physicochemical changes and, therefore, in the presence of numerous sources of pollution, as a rule, are anonymous. Furthermore, even if it is possible to determine at some given moment the section with the discharges of any one enterprise, the problem of continuity of measurements remains unsolved all the same.

From the theoretical point of view the concept of maximum permissible discharges also evokes a number of serious objections. The methodology of calculating standards and determining the place of the ecological aspect in economic activity seems unsubstantiated.

According to instructive documents, when norms of maximum permissible discharges are worked out, it is necessary to take the following into consideration: violations of the technological regime leading to emergency discharges; stoppages of gas purification equipment for repairs (in the absence of a reserve for its replacement); possible unfavorable changes in the composition of raw materials and fuel; meteorological conditions; background pollution of the atmosphere; prospects for the development of a region. However, even the consideration of all the enumerated factors does not yet make it possible to actually substantiate any significance of maximum permissible discharges whatsoever. In particular, we must not fail to take into account that depending

on the meteorological factors alone the volume of pollution in the ground layer of the atmosphere can fluctuate several dozens of times. If we proceed from the least favorable meteorological conditions and the possibility of emergency discharges and disconnection of gas purification equipment, without any doubt the norms of maximum permissible discharges will not be feasible. To base ourselves on averaged or optimal internal and external conditions means to disregard the possibility of exceeding maximum permissible concentrations of pollutants in the ground layer of the atmosphere. It turns out that mobile norms of maximum permissible discharges are necessary. However, standards varying depending on a change, for example, in weather conditions can no longer be called standards.

Nor should deviations from the norm be the norm. Therefore, the demand to take into consideration in the calculation of maximum permissible discharges violations in the technological regime and stoppages of gas purification equipment for repairs contained in instructions evokes bewilderment. The standardization of discharges cannot be based on deviations from the normal operating regime of an enterprise.

The problem of the place of the ecological aspect in economic activity is not solved comprehensively in the concept of maximum permissible discharges. Essentially, the production activity and the nature protection activity of an enterprise are viewed separately from each other. The appearance in plans of the section of nature protection, in fact, signifies the withdrawal of resources for passive types of nature protection measures not connected with the expenditures on improving production technology. However, this path is not promising. Every year the volume of funds necessary for nature protection will increase and with such an approach the attainment of nature protection goals externally will be an ever more significant factor in a decrease in the efficiency of public production.

Thus, the highly radical, at first glance, control over the state of the environment by means of the norms of maximum permissible discharges, in fact, proves to be insufficiently constructive. As already stated, the point is that the formulation of the tasks of a full attainment of the standard state of the environment is still premature as of now. At the same time, it is necessary to draw the most serious attention to the fact that to this day work on an efficient utilization of natural resources is of an initiative nature, not strictly obligatory for every enterprise. Essentially, the fulfillment or nonfulfillment of planned assignments for nature protection is not reflected in the evaluation of the economic activity of an enterprise and does not affect its economic incentive funds. The essence of the problem lies in the fact that conditions ensuring the interest of ministries and enterprises in an efficient nature use have not yet been created in the economic mechanism. A solution of such a problem is certainly urgent and fully realistic.

As a rule, the economic aspect of the ecological problem is illuminated from the position of development of cost accounting relations in nature use. At the same time, principal attention is paid to the monetary evaluation of natural resources and to the estimate of the damage from environmental pollution. However, the introduction of a charge for the use of natural resources and a

system of fines for pollution will not have a sufficiently significant effect on the evaluation of the activity of enterprises and will leave them the possibility of adopting alternative decisions in matters of nature use. Obviously, such an approach to the problem does not take into consideration the possibilities of the socialist state in economic management. A direct planning of the quality of nature use corresponds to a much greater degree to socialist production relations. For this appropriate planned indicators organically connected with the basic activity of enterprises should be included in the criteria of evaluation of the work of production collectives.

The insuffiently effective utilization of fuel, raw materials and supplies is the main reason for the unfavorable ecological situation. Therefore, an efficient utilization of material resources is the most promising direction in environmental protection. In our opinion, scientists at the Zaporozhye Public Laboratory of Nature Protection and Production Ecologization, who believe that the coefficient of utilization of material resources is the most important indicator of the quality of nature use, are completely right. For an industrial enterprise it can be calculated by relating the total weight of finished products to the weight of substances used during their production.[4]

An increase in the efficiency of utilization of material resources, in addition to an environment protection effect, gives a big economic effect. An overall utilization of minerals, a reduction in the norms of expenditure of resources per unit of output and an extensive application of secondary raw materials, on the one hand, lead to a decrease in environmental pollution and, on the other, to an expansion of the resource base of production.

We believe that the indicator of the level of utilization of material resources as the main indicator of production ecologization (which means, to a greater degree, of its technological level as well) should be of a directive nature and fund forming. In practice, its advantages would be manifested in the fact that work on the purification of discharges would be considered a means of a fuller utilization of resources involved in production. Such work would organically form part of the technology of production processes. The more toxic the waste of an enterprise is, the higher the demands placed on the coefficient of utilization of substances should be. These demands should be reinforced with the priority of reconstruction of harmful production facilities during the distribution of capital investments. The planning of a rise in the level of utilization of material resources will be the necessary incentive for an improvement in technology for enterprises and ministries.

For an all-around evaluation of the ecological aspect of economic activity and increase in the responsibility of enterprises in matters of nature use it is also advisable to work out and approve the following standards in five-year plans for sectors polluting the environment: of specific discharges of pollutants into the air and water;[5] of residual production waste per unit of output; of the level of waste utilization; of expenditures on the purification of discharges. The introduction of sectorial ecological standards into the planning practice will contribute to the strengthening of technological discipline, to an extensive popularization of the experience in an efficient nature use and to an increase in the efficiency of utilization of funds allocated for nature protection.

The calculation of standards of specific pollution should be based on the achievements of advanced enterprises in a sector, which most efficiently utilize natural and raw material resources and have modern systems of purification of discharges. When changing over to the standard technology of production of products ensuring the smallest volume of discharges of polluting components (with due regard for their harmfulness), the enterprise will be provided with incentives in the form of deductions into economic incentive funds on the basis of an increase in the coefficient of utilization of substances. The model of calculation of the standard of specific discharges can be represented as follows:

$$Y = \frac{O(1-K)}{\Pi},$$

where O is the volume of substances formed in a year (total number and according to ingredients) from all sources of pollution of the air (water) basin, tons; K is the coefficient of recovery of substances by purification systems; $\Pi$ is the annual volume of output, tons (in terms of cost evaluation).

The number of polluting substances is calculated on the basis of material balances of the technological processes specialized for a given sector. As already noted, the volumes of formed harmful substances are now shown by an enterprise in the form of the technical, industrial and financial plan (55-TP) and statistical reporting (2-TP). The methods of calculating the volumes of formed waste are worked out by sectorial scientific research institutes. It is important that the evaluation of new technologies promising for a sector be made with due regard for the indicator reflecting the number of substances polluting the environment.

The coefficient of recovery of substances is defined as a weighted mean taking into consideration the ingredient structure of discharges and the certificate data of the purification systems used in a sector. When the intensity of purification is increased, the specific capital intensiveness of recovery of harmful substances rises sharply. Therefore, it is necessary to establish limits of the economic advisability for the level of recovery. This requires standards of expenditures on the purification of discharges.

The volume of output in the sectors of the extractive industry and of the industry of initial processing of raw materials and in power engineering should be given in physical or standard-physical indicators and in sectors of the processing industry with a wide assortment of products, in value indicators. In the second case the indicator of gross output should be used, because the indicator of commodity or sold output does not take into consideration incomplete production, whose appearance also requires the formation of waste, and the indicator of standard net output does not take into account the value of raw materials, fuel and supplies, on whose quantity and quality the amounts of formed harmful substances depend directly.

When specific discharges are normed, it is necessary to proceed from a strict observance of the technological discipline of production processes. At the same time, it is advisable to proceed from the utilization of ecologically

inferior types of raw materials and fuel in production. When forecasting the ecological situation in a region, this will make it possible to get a realistic idea of the maximum extent of the possible pollution of the environment. In practice, the introduction of technologically substantiated standards of specific discharges will require from enterprises the elimination of emergency discharges connected with violations of the technological regime and of unorganized discharges caused by the lack or malfunction of purification systems.

Control over the observance by enterprises of standards of specific discharges can be exercised by checking the applied production technology, technological discipline and the technical state of purification installations and devices. Such control is of a preventive nature and is much more effective than fixation of violations already committed by enterprises. According to the data of controlling organizations, the malfunction of purification installations existing at enterprises and the poor regulation of motor engines are the causes of no less than 25 percent of the total volume of pollution of the atmospheric air.[6] Therefore, competent and regular control over technological discipline will greatly contribute to a decrease in environmental pollution.

Standards of specific discharges also presuppose the development of standards of residual production waste per unit of output, together with which they constitute a single system of indicators of waste formed in a sector. The model of calculation of the standard of residual production waste can be represented in the following manner:

$$y_{\text{ост}} = \frac{O_a K_a + O_в K_в + O_н}{П},$$

where $O_a K_a$ is the volume of waste of purification of discharges into the atmosphere annually recovered by dust and gas purification equipment; $O_в K_в$ is the volume of waste of runoff purification annually extracted by purification installations; $O_н$ is the volume of other annually formed waste; П is the annual volume of output.

The development of sectorial standards of residual production waste per unit of output will contribute to a strict calculation of all secondary material resources and will create the planned basis for their overall utilization. The application of these standards will also serve as an efficient means of controlling the level of purification of industrial runoff and discharge.

For an overall utilization of secondary material resources it seems necessary to introduce sectorial standards of waste utilization into the practice of planning. The form 55-TP of the technical, industrial and financial plan of an enterprise contains indicators of utilization of valuable substances from sewage and discharge into the atmosphere. However, these indicators, not being correlated with the actual possibilities of utilization, do not stimulate labor collectives to activate their efforts in this area. As a result, work on waste utilization has not been obligatory for enterprises to this day.

As we assume, utilization standards should become approved indicators of the plans for the utilization of incidental products and byproducts and secondary materials. The development of such plans is envisaged by the decree

dated 12 July 1979 of the CPSU Central Committee and the USSR Council of Ministers. The indicated standards could be the basis for planned assignments for sectors for the production of commodity products from waste. The appropriate capital investments should be allocated for ministries and departments for the development of utilization capacities. The volume of deliveries of material resources to consumer enterprises can also be planned on the basis of waste utilization standards.

Utilization standards are calculated on the basis of sectorial standards of residual production waste per unit of output. The level of utilization can be established by the method of expert evaluations with due regard for the attained advances in the utilization of various types of waste in a sector and existing production possibilities of utilization. In our opinion, it is advisable to regularly raise waste utilization standards. A rise in the level of utilization will be stimulated by deductions into economic incentive funds on the basis of an increase in the coefficient of utilization of material resources. For an above-standard utilization of waste deductions into economic incentive funds should be made according to higher standards.

Standards of expenditures on discharge purification can be of two types, that is, standards of current expenditures related to production costs; standards of reduced expenditures related to the volume of polluting substances annually recovered by purification systems. Standards of the first group are calculated as part of the socially necessary expenditures on the production of products by a sector's enterprises. As noted above, work of the nature of purification is an integral part of the technology of the production process. Therefore, expenditures on discharge purification in standard amounts should be included in production costs. The need to lower increased production expenses will accelerate the development and introduction of low-waste technologies. The standards of the second group, on the one hand, since they establish the limits of economic advisability for the purification level, can be utilized in the calculation of standards of specific discharges and, on the other, make it possible to get an idea of the environment protection effectiveness of nature protection expenditures and to substantiate the volumes of capital investments necessary for their financing.

At present an analysis of the efficiency of nature protection activity of enterprises is hampered owing to the noncomparability of data on the results of various measures of this type contained in forms 2-TP (air) and 2-TP (water resources) with data on expenditures, which in the form 4-OS are given in a single line for all types of measures. The noncomparability of data on expenditures and results of nature protection activity deprives planned measures of an economic substantiation and does not make it possible to draw a conclusion on the degree of correspondence of the actual level of nature protection expenditures to the actual requirements for the protection of nature.

Standardization of the environment protection effectiveness of expenditures on discharge and runoff purification will regulate the utilization of capital allocated for the protection of air and water basins. In this connection it is necessary to note the obvious advantages of indicators of environment protection effectiveness, which have a real content, over indicators of economic

effectiveness of nature protection expenditures, which are calculated on the basis of a monetary evaluation of the prevented damage from environmental pollution. Since the expenditures on a reduction in environmental pollution are charged to an enterprise, but the effect from this reduction is manifested at a regional level, no calculation of economic efficiency will convince an enterprise of the need for the protection of nature.

The proposed system of sectorial ecological standards will not only strengthen the responsibility of enterprises for an efficient nature use, but will also enable local soviets to perform in a full volume the functions of coordination and control over the activity in this area. Proceeding from data on sectorial ecological standards and the volumes and dynamics of production, regional bodies can give substantiated conclusions on the schemes of development and placement of national economic sectors on territories subordinate to them right up to the establishment of certain ecological restrictions, that is, volumes of output at existing enterprises or of the placement of new industries having relatively high specific discharges on ecologically unfavorable territories.

To prevent dangerous levels of pollution of the air basin of cities, it is necessary to continue the practice of servicing enterprises with forecasts of unfavorable meteorological conditions contributing to an increase in the concentration of harmful admixtures in the ground layer. The forecasts transmitted to an enterprise should serve as a legal basis for a temporary stoppage of production processes connected with a considerable pollution of the environment.

Thus, if the proposed system of ecological standards is developed and applied, organs of regional management, having data on sectorial standards of specific discharges, will get the opportunity of establishing restrictions directly on the volumes of output, not on discharges polluting the environment, which, in practice, it is impossible to control. Restrictions on the volumes of production should be imposed primarily on enterprises applying obsolete technology. Granting such a law to local soviets will contribute to an improvement in the ecological situation and to an accelerated reconstruction of old production facilities.

FOOTNOTES

1. See: "Materialy XXVI s"yezda KPSS" /Materials of the 26th CPSU Congress/, Moscow, 1981, p 184.

2. See: IZVESTIYA, 1980, 27 June, p 2.

3. See: PLANOVOYE KHOZYAYSTVO, 1979, No 12, p 56.

4. See: "Sokhraneniye okruzhayushchey sredy na osnove bezotkhodnogo proizvodstva" /Preservation of the Environment on the Basis of Waste-Free Production/, Leningrad, 1977, p 14.

5. Experience in the preparation of such standards was accumulated at the All-Union Scientific Research Institute of Water Supply, Sewer Systems, Hydraulic Engineering Structures and Engineering Hydrogeology, which since 1973 has been developing consolidated norms of water diversion (including polluted sewage) and water consumption per unit of output in basic industrial sectors.

6. See: IZVESTIYA, 1980, 16 March, p 3.



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